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PHYSIOGRAPHIC EFFECTS OF THE VOLCANISM OF MT. ST. HELENS *

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Mt. St. Helens, lying roughly midway between Mts. Rainier and Hood, is more remote and less well-known than either of these peaks. The plateau from which it rises is minutely dissected and densely forested. Only two wagon roads, bad beyond description, approach the mountain fastness; none traverse it. The lower river bottom farms, rich though circumscribed, become gradually smaller and poorer as one approaches the headwaters. Lately fenced grass-carpeted meadows, studded with neat white-painted barns and houses, give way to bushy stump-lot clearings and single-room log cabins. These in turn becoming more infrequent stand with their backs to the virgin timberland of hill and mountain side. All through the countless inner hills and valleys, beside abandoned overgrown trails and again in the most remote and inaccessible places, are found deserted cabins, now moldering into ruins, the homes of former prospectors. Though indications of mineral wealth—gold, silver, and copper—sufficient to fascinate the novice may be found at every hand, the miserable failure of the region generally to respond to diligent search and commercial exploitation is only too apparent. The great forests of Douglas fir and kindred evergreens, now largely protected within the Federal Columbian Forest Reserve, stand as the greatest natural resource of economic importance. But to the state and the nation the region finds its first value as a paradise for the tourist and nature lover.

Configuration and Lines of Ascent

From an altitude at the base of about 4,500 feet the snow-capped summit of Mt. St. Helens rises to an altitude of 9,761 feet above mean sea level (see Fig. 1). The shape of the mountain is that of a symmetrical cone with crestal angles figured from the crest for the highest and last mile as follows: (1) to the southwest in the direction of Butte Camp, 31½°; (2) to the northwest in the direction of Toutle River canyon, 27½°; (3) to the northeast in the direction of the headwaters of Smith's Creek, 23°; (4) to the southeast in the direction of the headwaters of Muddy River, 27°. Notwithstanding the fact that the angle of inclination from Butte Camp to the crest of Mt. St. Helens is, as shown above, slightly sharper, it is coincident with the trail most frequently taken by mountain-climbing tourists. The selection of this line of ascent is due principally to its accessibility. It is possible, how-

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* The field work on which the data incorporated in this paper are based was done by the writer during the spring, summer, and autumn of the year 1915 while he was a member of a U. S. Geological Survey field party mapping the Mt. St. Helens quadrangle.

ever, as has been demonstrated, to climb the mountain from several angles.

The volcanism which found active expression as recently as the early part of the last century [1] has been responsible for the creation of a number of physiographic features which lend individuality to this old cone. Interesting as are the problems they present, these surficial peculiarities have as yet received little attention in geological and geographical literature.

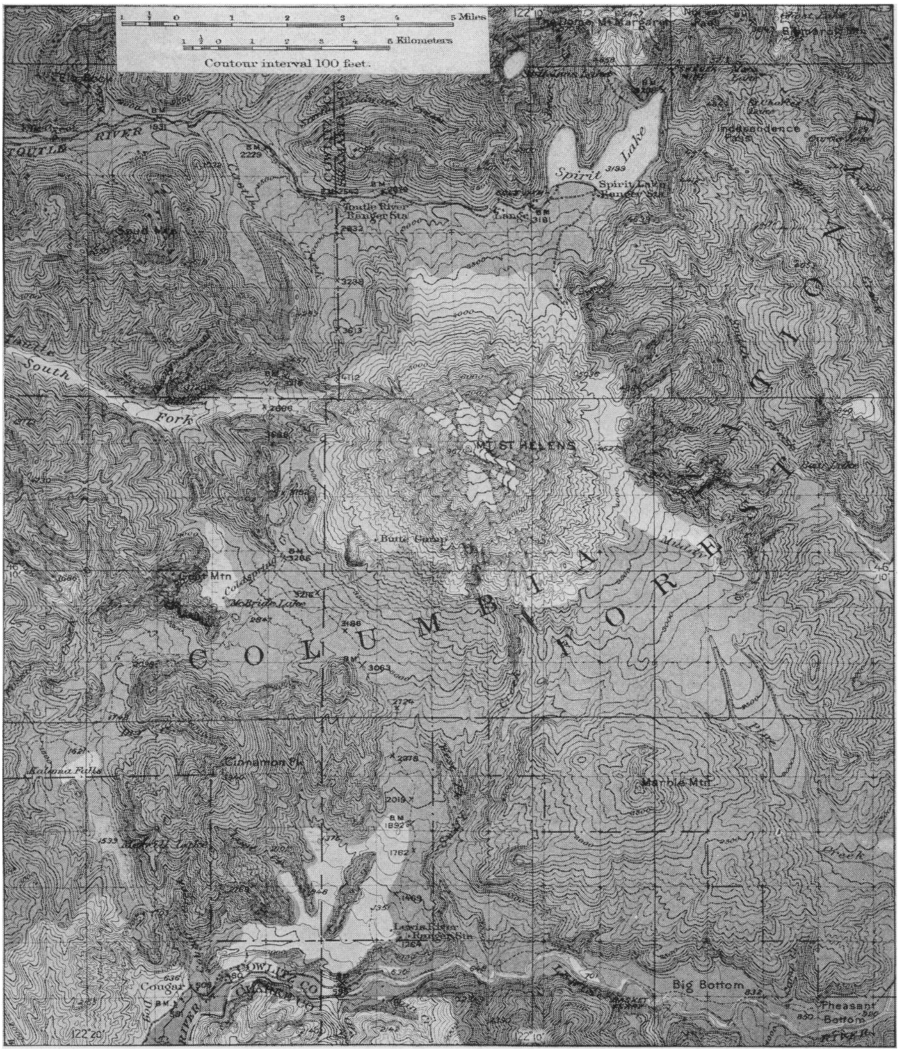

FIG. 1—Contour map of Mt. St. Helens. Scale 1:290,000. (Reproduced from the Mt. St. Helens topographic sheet, 1:125,000, of the U. S. Geological Survey, 191.)

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[1] The Volcanic Activity of Mount St. Helens and Mount Hood in Historical Time, *Geogr. Rev.*, Vol. 3, 1917, pp. 481–485.

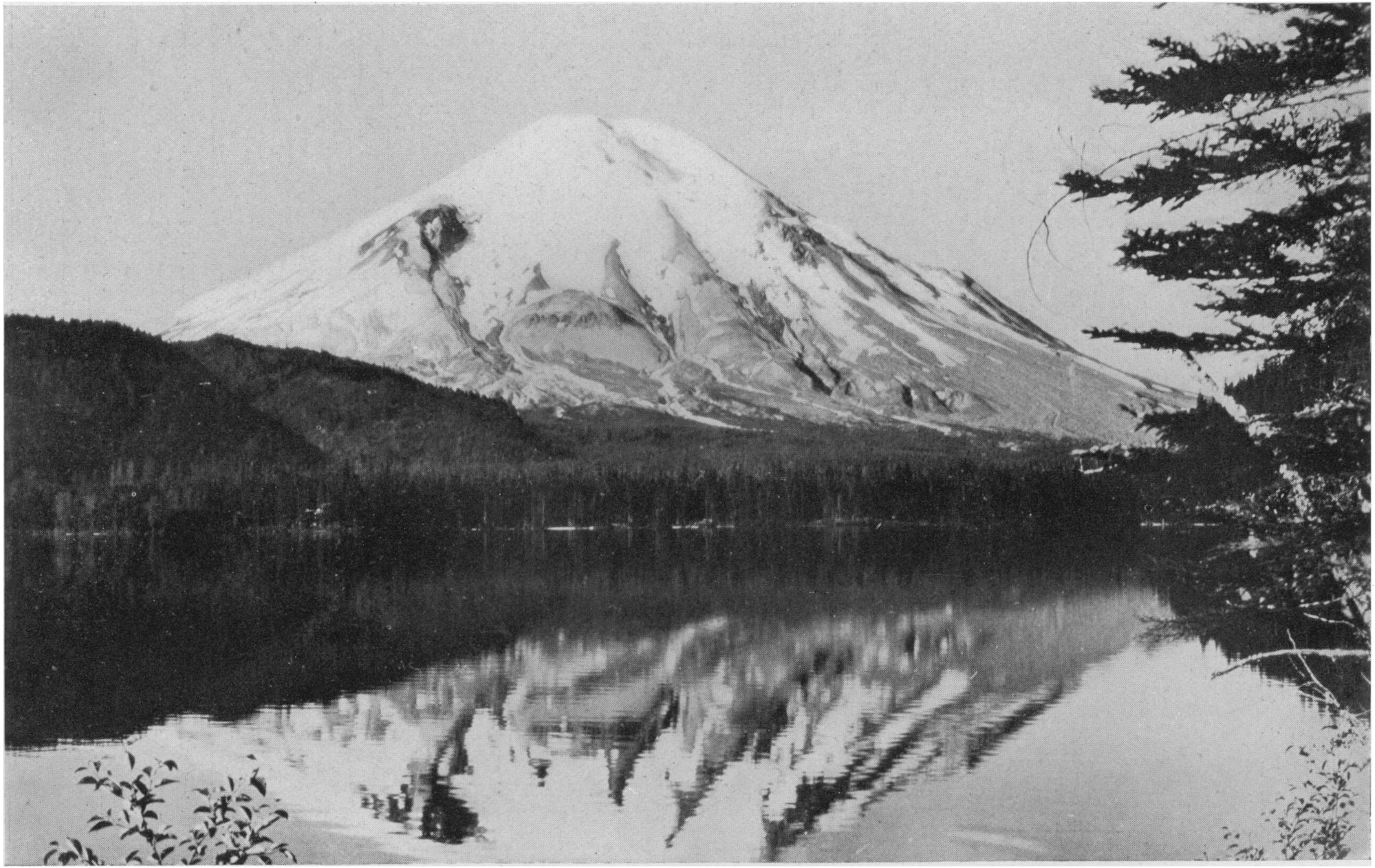

FIG. 2—Mt. St. Helens and Spirit Lake in early summer.

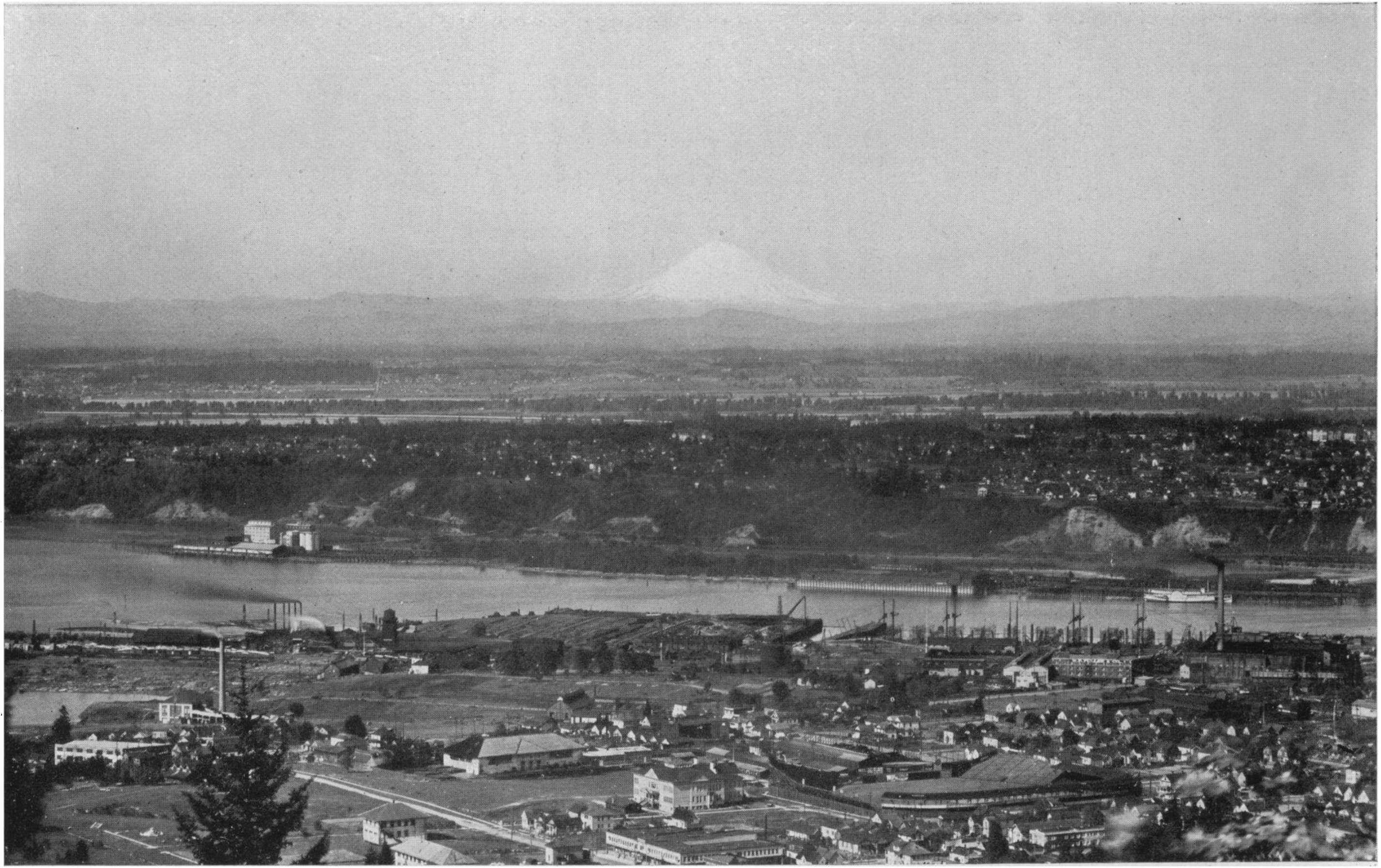

FIG. 3—Mt. St. Helens from King's Heights above Portland, Ore. The view is to the north, and the Columbia River in the middle foreground is flowing to the left. This view shows the symmetrical snow-capped appearance of Mt. St. Helens in the spring and fall.

PYROCLASTIC DEPOSITS AND LAKE FORMATION

In the large amounts of pyroclastic materials and the succession of lava flows ample evidence may be noted of a rather extended period or series of periods of explosive and then quieter effusive eruptions. On the southwestern flank the headwaters of Kalama River from the vicinity of McBride Lake to below Kalama Falls have been buried under a very thick deposit of pyroclastic material, which, with other geologic agencies probably of an intrusive nature, have operated to dam up the waters of a northwestward-flowing branch of Kalama River and form Merrill Lake. This mountain pond has an elevation of 1,533 feet, is elongate in figure, and boasts two small rocky islands, uneroded ridges in the old valley. McBride Lake, located just to the east of Goat Mountain, and one or two other smaller ponds in this same vicinity were formed by the same deep deposit in which the Kalama River has cut for itself a deep, canyon-like channel.

The South Fork of Toutle River, flowing slightly to the north of west from Mt. St. Helens and fed in part by melting glacial waters, is entrenched deeply in a narrow boulder-clogged valley. There is a difference of relief of 2,500 feet from the Toutle River bed to Spud Mountain on the north and of 2,800 feet to Goat Mountain on the south. Both headwater branches of the South Fork of Toutle River head against the western slope of Mt. St. Helens proper in very precipitous canyons gouged out of fragmental débris several hundred feet deep.

Immense deposits of pyroclastics are to be found in the valley of the North Fork of Toutle River. The fill has been so general that an undulating river plain in many places over a mile in width has been developed. The river channel itself is boulder-choked and, like all of the streams heading in Mt. St. Helens, is very heavily overloaded. Great alluvial fans of fragmental materials, mostly of a very fine character, are found in the North Fork valley at the base of the mountain. Their development here has resulted again in effectually damming the headwaters of North Fork and producing the beautiful and widely known Spirit Lake. This little lake, with waters icy cold and sparkling, lies like a crystal emerald at the northern base of Mt. St. Helens. Its surface elevation is 3,199 feet, and, unlike Merrill Lake, it has a surface stream outlet.

LAVA DEPOSITS ON THE EASTERN AND SOUTHERN SLOPES

On the eastern and northeastern side of Mt. St. Helens the original dendritic drainage of Smith's Creek, a southeastward-flowing tributary of Muddy River, approaches within three miles of the crest of the old volcano. The essential absence of volcanic fragmental materials and lavas on this side at elevations below 4,000 feet is conspicuous and interesting. On the southeastern and southern flanks of the mountain about the headwaters of Muddy River, Pine Creek, Swift Creek, all southward or southeastward-flowing tributaries of Lewis River, there is found the largest single expanse of volcanically modified physiography in the entire area. In this section

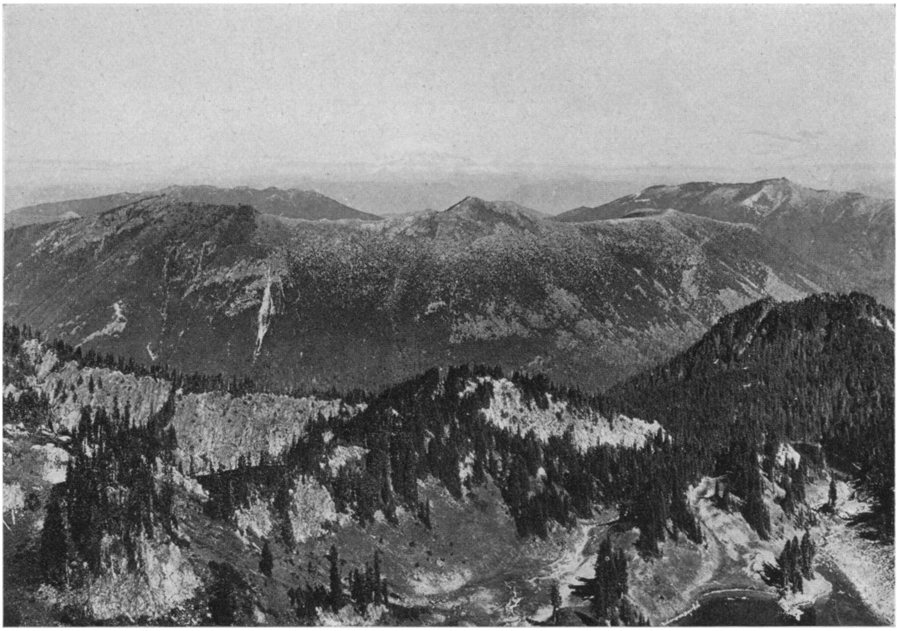

Fig. 4

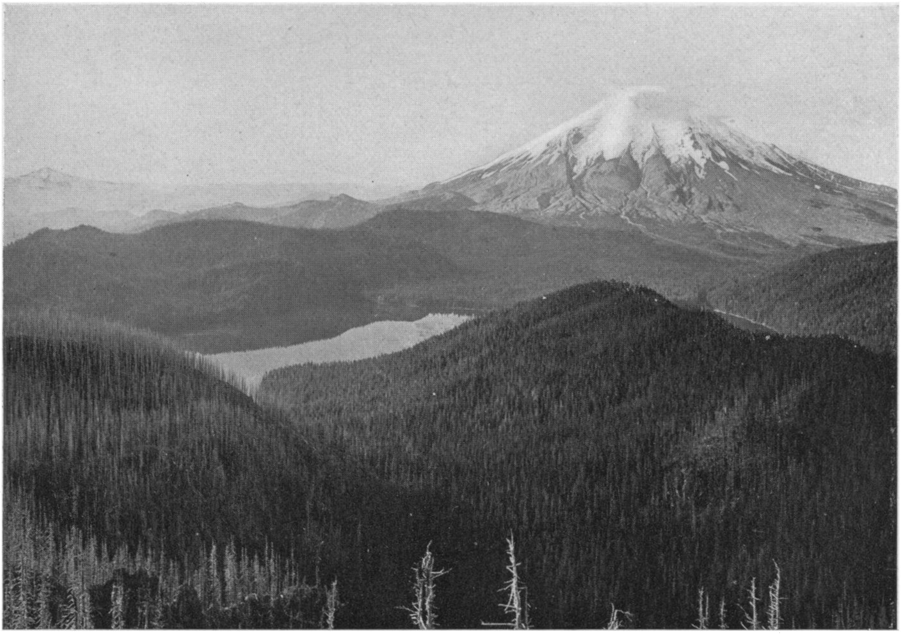

Fig. 5

Fig. 4—View looking northward from Mt. St. Helens across Spirit Lake. Mt. Rainier is faintly seen in the far distance.

Fig. 5—Mt. St. Helens and Spirit Lake from the crest of Mt. Margaret, looking slightly west of south. The view from here shows clearly the consistent accordance of summit levels.

pyroclastics occur only in relatively insignificant quantity. This whole area, comprising between 40 and 50 square miles, is a broad southward and southeastward-sloping lava flow. The lava in many places is hundreds, perhaps thousands, of feet thick. It extends from the base of the mountain to the waters of Lewis River. At this point its rapidly increasing viscosity, induced by contact with the then swollen river, caused it to pile up several hundred feet in thickness in the debouchures of the former creeks and branches. The more liquid flows behind were ponded, and the crests of the former ridges were left as the only abrupt physiographic features of the immediate vicinity—rock islands in a sea of rocks. These broad and probably more or less quiet, though destructive, lava extensions distributed themselves between Marble Mountain (4,100 feet) and Cinnamon Peak (3,940 feet), which elevations are remarkable only as the highest points of the country rock presenting the original accordance of summit levels.

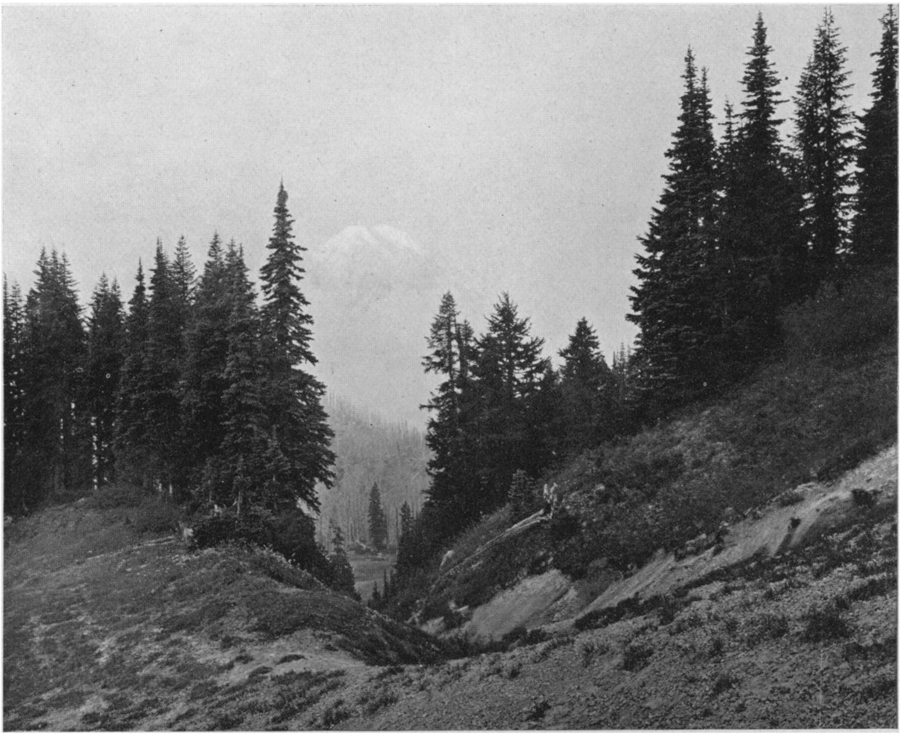

FIG. 6—Overshadowing the surrounding hill country in height and magnificent grandeur, the snow-capped crest of Mt. St. Helens may be seen from practically every adjacent creek and valley. This view is from the Toutle River bottom land.

TOPOGRAPHY OF THE REGION

A careful examination of the topography, both in the field and as reproduced on the Mt. St. Helens quadrangle, reveals a region broadly uplifted between 2,000 and 3,000 feet, with a somewhat poorly defined major axis about 20° east of north in the Mt. St. Helens vicinity. This axis will fall in line generally with Cinnamon Peak (3,940 feet); the crest of Mt. St. Helens and the lesser peaks to the immediate north; the Dome (5,703 feet); Mt. Margaret (5,847 feet); Mt. Whittier (5,818 feet); Goat Mountain (5,390 feet); Strawberry Mountain (5,732 feet); and Tumwater Mountain (5,249 feet)—the latter three of which form a portion of the southern watershed of Cowlitz River and its southern fork, Cispus River. Mt. St. Helens is located toward the southern extremity of this broad uplift, the first volcanic eruptions having broken out in the then headwaters of the South Fork of Toutle River.

NATURAL PHENOMENA OF INTEREST TO THE EXPLORER

For the ardent explorer the Mt. St. Helens region offers many natural phenomena of interest besides the superb mountain scenery at every hand. If he goes in by the Lewis River post road with the mail he will stop at the end of a full day's travel at Cougar, which is a log cabin post office and the end of the route. Here the great southern lava flows with their old fumaroles and small gas cones are within a mile's walk. A climb of five hundred feet from the river level brings one to the top of the flow, where large areas of submerged forests are seen to have stood, the rough scoriaceous lava having filled in about them *in situ*. Where the great trees once stood the traveler will see hundreds of vertical or semi-vertical manholes in the former lava flood, now cold and partly moss-covered. If he examines closely these chilled lavas he will note that their surfaces are pitted and grooved as casts of the charred timber about which the cooling lava set into solid rock.

About a mile up the lava flow, at an elevation of 1,351 feet, occurs the lower entrance to the largest of the several lava caves of the Mt. St. Helens district. It is reported that this cave, which is really an elongate abandoned lava channel, is over a mile in length. This report, though it may be true, is not herewith authenticated. The lava cave trail will lead the mountaineer to McBride Lake or Butte Camp, if he cares to follow it, from whence he may easily make the ascent of the main elevation of Mt. St. Helens in one day, returning to Butte Camp for the night. He may then return over the Kalama River trail, passing by Kalama Falls and Merrill Lake where, if he cares to tarry, unsurpassable trout fishing may be found.

A more extended trip, and one of very great interest, takes the traveler to Lange post office on the shore of Spirit Lake north of Mt. St. Helens. The Toutle River trail, which swings to the north below Butte Camp, crosses the South Toutle River canyon at an elevation of 2,886 feet and continues almost due north to North Toutle River, whence it turns east three miles to Lange and Spirit Lake. On leaving Lange the traveler may either retrace his steps to Cougar or go out with the mail down the valley of North Toutle River to Castle Rock and Cowlitz River.